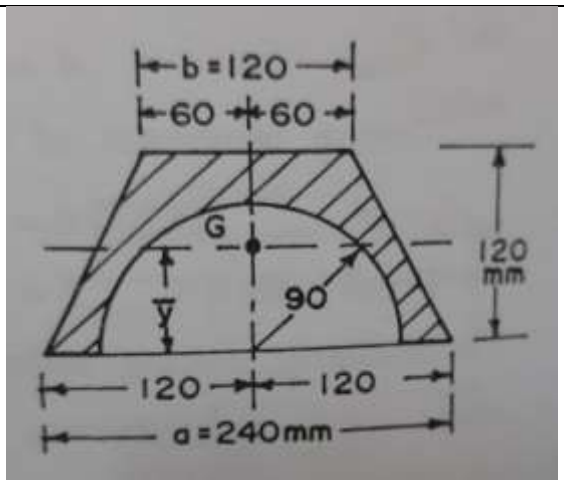
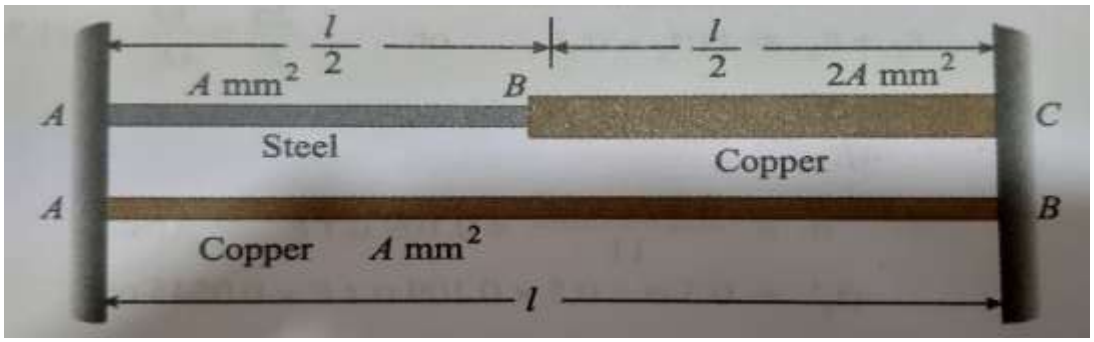
Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

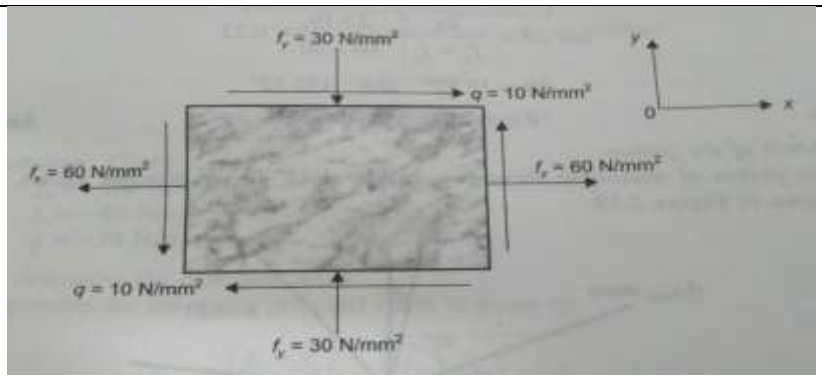
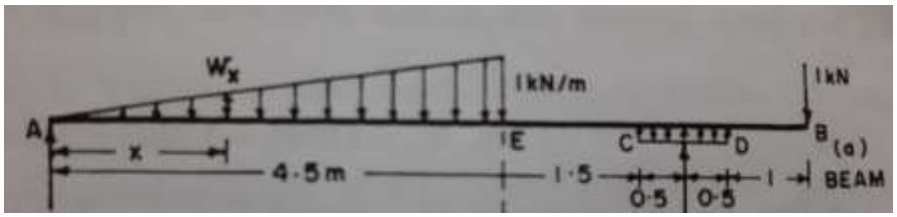
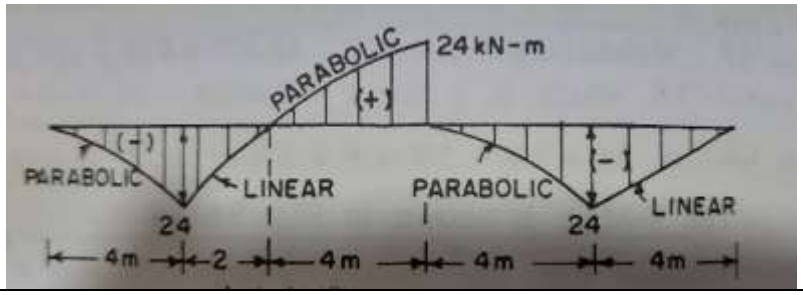
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Programme Name: **B. Tech. FSE** **Semester : IV**
Course Name : **Strength of Materials** **Time : 03 hrs**
Course Code : **GNEG 227** **Max. Marks : 100**
Nos. of page(s) :

SECTION A

S. No.		Marks	CO
Q 1	**MCQ** a. A rod is enclosed centrally in a tube and the assembly is tightened by rigid washers. If the assembly is subjected to a compressive load, then i. Rod is subjected to a compressive load, ii. Tube is subjected to a compressive load, iii. Both are subjected to a compressive load, iv. Rod is subjected to a compressive load, while the tube is subjected to a tensile load. b. When a body is subjected to a direct tensile stress (σ) in one plane, then the tangential stress on an oblique section of the body inclined at an angle (θ) to normal of the section is equal to i. $\sigma \sin \theta$ ii. $\sigma \cos \theta$ iii. $\sigma \sin^2 \theta$ iv. $\sigma \cos^2 \theta$ c. The total strain energy stored in a body is known as i. Impact energy ii. Resilience iii. Proof resilience iv. Modulus of resilience d. When a cantilever is loaded at its free end, maximum compressive stress shall develop at i. Bottom fiber ii. Top fiber iii. Neutral axis iv. Centre of gravity	**4**	**CO1**
Q 2	**Define** a. Curvature of Section b. Neutral Axis c. Angle of Obliquity d. Impact loading	**4**	**CO1**
Q 3	Determine the position of centroid of the plane as shown in fig.	**4**	**CO3**

			
Q 4	An axial pull of 20 kN suddenly applied on a steel rod 2.5 m long and 1000 mm2 in cross-section. Calculate the strain energy, which can be absorbed in the rod. Take E = 200 GPa.	**4**	**CO2**
Q 5	Show that in a strained material subjected to two-dimensional stress, the sum of the normal components of the stresses on any two mutually perpendicular plane is constant.	**4**	**CO2**
	SECTION B		
Q 6	A composite bar is made up by connecting a steel member and a copper member, rigidly fixed at their ends as shown in fig.  The cross-sectional area of the steel member is A mm^2 for half of the length and 2A mm^2 for another half of the length, while that for the copper member is A mm^2. The coefficient of expansion for the steel and copper are α and 1.3α, while elastic modulii are E and 0.5E respectively. Determine the stresses induced in both the members when the composite bar is subjected to a rise of temperature of t degrees.	**10**	**CO4**
Q 7	Two elastic bars of the same material and length, one of circular section of diameter d and the other of square section of side d, absorb the same amount of energy delivered by axial forces. Compare the stresses in two bars.	**10**	**CO3**
Q 8	A plane element is subjected to stresses as shown in figure. Determine the principle stresses, the maximum shear stress and their plane. Sketch the planes determined.	**10**	**CO4**

			
Q 9	An element cube is subjected to tensile stresses of 110 N/mm^2 and 47 N/mm^2 acting on two mutually perpendicular planes. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2, such that the one associated with the former tensile stress tends to rotate the element counterclockwise. Find the magnitude of the stresses on a plane inclined at 45° to the principle planes.	**10**	**CO4**
	SECTION-C		
Q 10	A beam AB, 8 m long and supported at A, has a simple support of 1 m length between C and D. Assuming uniformly distributed reaction between C and D, draw the S.F. and B.M. diagrams for the loading shown in Fig. 	**20**	**CO5**
Q 11	A beam ABCD is supported at B & C and has overhangs AB and CD. The B.M. diagram for the beam is shown in fig. Draw the loading on the beam and S.F. diagram. 	**20**	**CO5**